Nuclear Phenomena in Ustilagineæ. — Contributions such as Professor Harper presents[1] have been few, but are much needed to explain this class of plants. He studied, in particular, the germination, growth, divisions, and fusions of *Ustilago antherarum* and *U. Scabiosæ*. He finds that in fusions of conidia, which are apparently caused by chemotactic stimuli, no nuclear changes take place, yet the cytoplasmic union of the cells causes them to increase in size, and gives them power to resist unfavorable conditions. It may be a primitive or degenerate sexual union.

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Cell Division in Sporangia and Asci.[2] — Dr. Harper has contributed another very valuable investigation upon the morphology of the structures named. Among the Phycomycetes he has studied spore formation in sporangia of Synchitrium, Pilobolus, and Sporodinia, and for comparison, ascospore formation in *Lachnea scutellata* among the Ascomycetes, in which he was able to find stages undiscernible in his previous work on Peziza and Erysiphe.

In Synchitrium he regards the uninucleated cell as the vegetative body of the plant, the supervening multinucleate condition constituting, in his view, a sporangium rather than a thallus body. Cleavage by invagination of the plasma membrane follows this multinucleation, the contents of the "sporangium" being segmented, from without inward, into irregular plasma masses containing numerous nuclei. This cleavage resembles what is seen in some insect eggs. The segmentation of the protoplasm does not occur by repeated bipartitions or by the formation of walls, simultaneously, about the several nuclei. Orientation with respect to the nuclei is not evident at first, but becomes apparent later, in the final subdivision of the contents of the sporangium into uninucleate plasma segments. A shrinkage then occurs, followed by increase in size of these "protospores" and the subsequent repeated division of their single nuclei, to form from eight to twelve or more in a single "protospore." The number of them is not definite as in the ascus, but seems to depend, according to Harper, on the individual conditions of nutrition in the different "protospores."

Substantially the same cleavage process of spore formation was observed in three species of Pilobolus and in Sporodinia. There is nothing in the process of spore formation described in the Phycomy-

[1] Harper, R. C. Nuclear Phenomena in Certain Stages in the Development of the Smuts, *Trans. Wis. Acad. Sci.*, vol. xii, pp. 475–498, Pls. VIII, IX. October, 1899.

[2] R. A. Harper, in *Annals of Botany*, December, 1899.

cetes which at all resembles the free cell formation in the ascus, where the spores are cut out of the ascus plasm by the revolution of the aster rays. In the Phycomycetes we have isolation of the "protospores" by successive irregular segmentations, not simultaneous, but progressive. "This progressive segmentation has no parallel in the asci, where from the start a single nucleus forms the center for the formation of each daughter-cell" (p. 517). Harper finds it possible to connect the cleavage processes of the Phycomycetes with other cases of division by constriction, as in cell division in Cladophora, or in the abstriction of conidia in Erysiphe, as described by him, but he finds no connecting link between this general process of spore delimitation and free cell formation in the ascus. This stands as opposed to the older view of Brefeld that the ascus merely represents an evolution out of the ancestral sporangium, from an indefinite to a definite number of spores of definite size and form. Moreover, in the origin and character of the "epiplasm," regarded as a distinctive feature of the ascus, and that of the "episporal slime" of the sporangium, Harper finds no connection whatever. A possible origin of the processes seen in the ascus is suggested tentatively in such phenomena as Strasburger described (*Zellbildung und Zelltheilung*) for swarm-spore formation in Œdogonium. This, however, the author has not as yet been able to confirm by personal investigation.

The general conclusion is that the Ascomycetes cannot have arisen from the Phycomycetes, — the ascus seems to stand by itself as a peculiar structure, whose origin is at present in obscurity, — and, finally, the author's researches, together with those of Thaxter on the Laboulbeniaceæ, seem to point very strongly to a multiple algal origin of the fungi and the subsequent independent evolution of certain forms of spore production by different groups.

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Notes. — The Cactaceæ of the Galapagos Islands are passed in review, by Dr. Albert Weber, in the *Bulletin* of the Paris Museum for 1899, and four species are recognized, of which two, pertaining to the genus Cereus, are characterized as new, while the other two, belonging to the genus Opuntia, were described and named in 1898.

A. Purpus, of the Darmstadt Botanical Garden, publishes an article on North American cacti which have proved hardy in Germany, in *Die Gartenwelt* of January 7. Several reproductions from photographs represent the species referred to.